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PCT/GB 2003 / 0-0-3 872

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P01/7700 0.00-0220564.9

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(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)



The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference

JC/SPY

2. Patent application number

(The Patent Office will fill in this part)

0220564.9

- 4 SEP 2002

3. Full name, address and postcode of the or of each applicant (*underline all surnames*)

FORAC LIMITED

Brunswick Street East,
Hove,
East Sussex,
BN3 1AU

GB

602 685000

II

4. Title of the invention

Actuator Control Device

5. Name of your agent (*if you have one*)

J.C. BRIDGE-BUTLER

"Address for service" in the United Kingdom to which all correspondence should be sent
(*including the postcode*)

G.F. REDFERN & CO.
7 Staple Inn,
Holborn,
London WC1V 7QF

SEP 2002

14/12/005

II

Patents ADP number (*if you know it*)

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (*if you know it*) the or each application number

Country

Priority application number
(*if you know it*)

Date of filing
(*day / month / year*)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(*day / month / year*)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (*Answer 'Yes' if:*

Yes

- a) *any applicant named in part 3 is not an inventor, or*
- b) *there is an inventor who is not named as an applicant, or*
- c) *any named applicant is a corporate body.*

See note (d)

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form.
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Continuation sheets of this form

Description 5

Claim(s)

Dm

Abstract

Drawing(s)

H1

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination
(Patents Form 10/77)

Any other documents
(please specify)

11.

I/We request the grant of a patent on the basis of this application.

J.C. BRIDGE-BUTLER
Signature

Date
4 September 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

J.C. BRIDGE-BUTLER

020 7242 7680

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Notes

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Actuator Control Device

This invention relates to an actuator control device for use in particular, but not exclusively, with a pneumatic actuator.

Pneumatic actuators are used to activate valves which control the flow of a substance through a pipe or the like. These actuators may be positioned by means of a control device provided with solenoid valves. Many re-adjustments may be required to obtain a desired valve position, in particular if the desired position is not constant.

A typical electrically operated on/off solenoid valve has a life of approximately 50 million operations. In applications where the flow valves need to be constantly moved, the solenoid valves can expire in less than 12 months.

There are alternative mechanical ways of operating an actuator, however these are more expensive to manufacture and to purchase than those provided with the above described solenoid valves.

The present invention is intended to overcome some of the above problems.

According to the present invention an actuator control device is adapted to delay actuator movement towards a desired position if the actuator's actual position is within a predetermined distance therefrom.

Preferably the control device can delay actuator movement for a number of different predetermined time periods, which correspond to a number of sequential predetermined distances away from the actuator's desired position.

In one construction the predetermined delay periods decrease the further away from the desired position the actuator is. Therefore, if the actuator is a long way from its desired position there will be a small, or no, delay before the actuator is moved, however, if the actuator is very near to its desired position there will be a long delay before the actuator is moved.

The actuator can also be provided with two input signals, the first being the desired actuator position, and the second being the actual actuator position. The desired actuator position can be set via a control means accessible by the system operator. Alternatively, the desired position can be sent from another part of the plumbing of the system with which the actuator and valve is used, for example an active pressure monitoring means downstream of the flow valve. The actual actuator position can be provided by a potentiometer of a known construction.

The sequential predetermined distances can each be 0.7 degrees wide. The desired actuator position can be a 0.7 degrees wide band, which is provided with four further 0.7 degree bands on either side.

The predetermined delay periods can be 13 seconds in the first band outside the desired band, then 7 seconds, 4 seconds and 2 seconds. Therefore, when the actual actuator position is between 0.1 degrees and 0.7 degrees outside the desired 0.7 degree wide band, according to the difference between the two input signals, the control device will not move the actuator for 13 seconds. When the actuator is between 0.8 degrees and 1.4 degrees from the desired band, the delay is 7 seconds, and so on.

If the actuator's actual position changes to a different 0.7 degrees band during the delay period, the control device can be adapted to modify the delay period to correspond to the new position.

Therefore, if the actuator is positioned according to a 7 seconds delay, but moves after 5 seconds to the 13 seconds delay band, the actuator will operate after a further 8 seconds. However, if the actuator is positioned according to a 7 seconds delay, and moves after 5 seconds to the 4 seconds delay band, the actuator will operate immediately, because more than 4 seconds have elapsed.

With this arrangement actuator movements which may not be effective due to the actuator's constantly changing position are not made.

In one construction the actuator is provided with solenoid valves. The actuator can be a "spring return" actuator of any known type, in which the position of the actuator is controlled by an inlet solenoid valve and an exhaust solenoid valve which control a force which acts against a return force, for example a spring. In an alternative construction the actuator can be a "double acting" actuator of any known type, in which the position of the actuator is controlled by a number of solenoid valves adapted to control a force and a return force.

The actuator can be used to control a flow valve, the position of which may need to be constantly changed to maintain a constant output flow.

The present invention can be performed in various ways, but one embodiment will now be described by way of example, and with reference to the accompanying drawing, in which:

Figure 1 is a diagram displaying the features of an actuator control device according to the present invention.

In Figure 1 an actuator control device 1 is provided with an electronic program 2 which is adapted to delay the movement of a spring return actuator 3 to a desired position when the actuator's 3 actual position is within a predetermined distance from the desired position.

The control device 1 is connected to the actuator 3, which is connected to a flow valve 6.

The control device 1 is provided with a desired position input signal 4, and an actual position input signal 5. The actual position input signal 5 is drawn from the actual position of the valve stem 7 inside the actuator.

Figure 1 shows three potential actual position signals, A, B, and C.

In use the system operator, or an active pressure monitoring means downstream of the flow valve, provides a Desired position input signal 4. The Control device 1 then moves the actuator to that desired position, at which point the control device begins a timer.

If the actuator changes position by 1 degree, actual position input signal A is fed into the control device 1.

If after seven seconds the input signal A remains in the same 0.7 degrees wide band between 0.8 degrees and 1.4 degrees, the control device 1 will operate the actuator 3 and attempt to move it back in line with the desired position input signal 4.

However, if the input signal 5 changes to position B in less than 7 seconds, the actuator 3 is not moved by the control device 2, as the movement is no longer necessary.

In the event that the input signal 5 changes to another position outside the desired 0.7 degrees band in less than 7 seconds the actuator will operate according to the delay period corresponding to the new position. So, for example, if the actuator moves after 5 seconds to position C the actuator will operate immediately because more than 4 seconds have passed.

In the event that the input signal 5 is outside all of the nine 0.7 degree wide bands, there is no delay in operating the actuator 3.

Therefore, the control device operates the actuator, and the actuator's solenoid valves, far less than in a conventional arrangement.

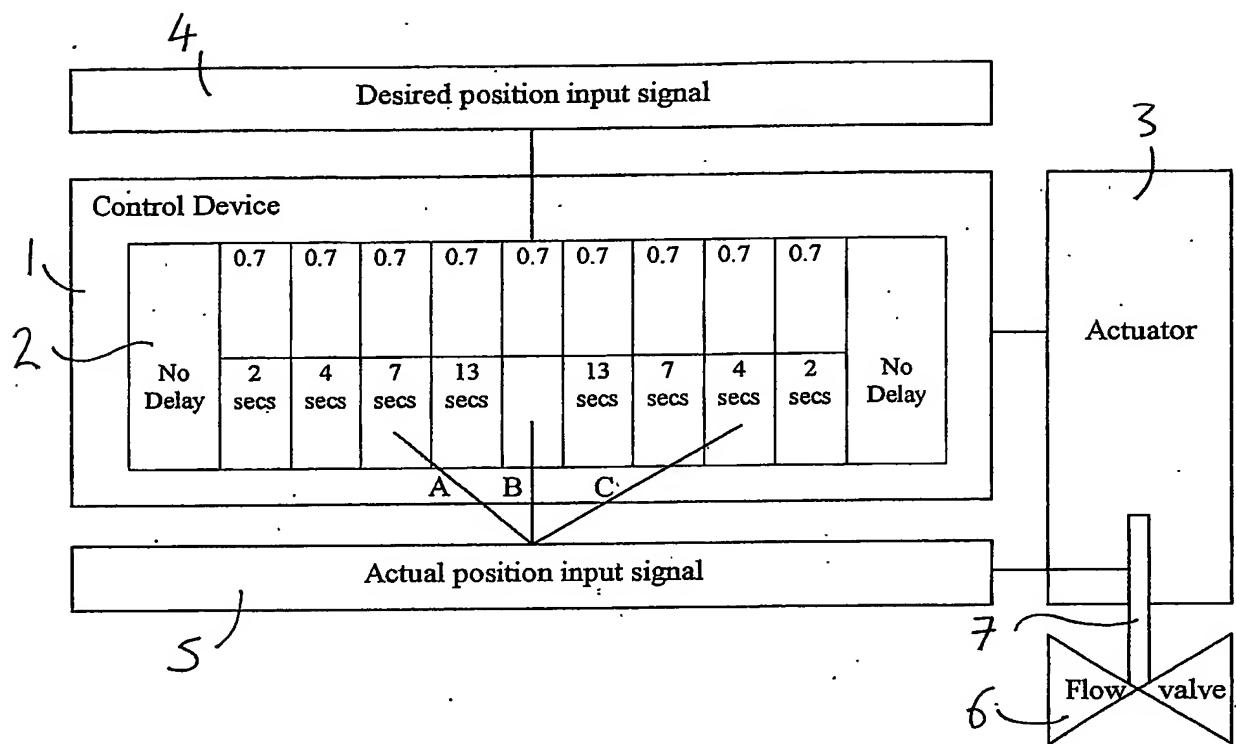
It will be appreciated that the predetermined distances and delay periods can be any desired amount, and are not restricted to those shown in Figure 1.

Further, it will be appreciated that the present invention can also be used to control a double acting actuator provided with inlet solenoid valves and exhaust solenoid valves. A single control device can be adapted to control these valves, operating a combination to move the actuator in one direction, and another combination to move it in the opposite direction.

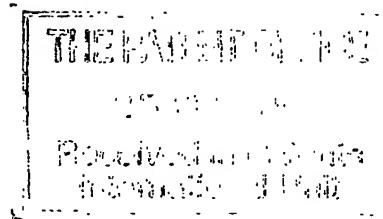
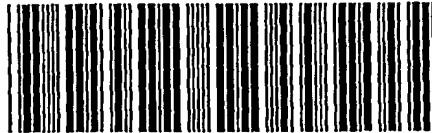
It has been found that with the above program of delay sequences, the life time of a typical solenoid valve in an actuator is extended by over 10 times. It has been further found that the delay system incorporated into the above described system does not effect the flow of the substance through the flow valve to any appreciable extent.

Therefore an actuator control device is provided which uses inexpensive solenoid valves whilst giving long life and good control.

Fig 1



PCT Application
GB0303872



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Prior Applications: **GB-A-02 20564.9 filed 4 September 2002**

I hereby acknowledge the duty to disclose information that is known by me to be material to patentability as defined by 37 C.F.R. § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the PCT international filing date of the continuation-in-part application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Date: **4 SEPT 2003**

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